Model PCL-711B

PC-MultiLab Card

PCL-711 B

PC-MultiLab CARD

USER'S MANUAL

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TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION 1
1.1. Features 1
1.2. Specifications 1
1.2.1. Analog Input (A/D Converter) 1
1.2.2. Analog Output (D/A Converter) 2
1.2.3. Digital Input 3
1.2.4. Digital Output 3
1.2.5. General Specifications 3

CHAPTER 2. INSTALLATION 5
2.1. Initial Inspection 5
2.2. Switch and Jumper Settings 5
2.2.1. I/O Address Selection 6
2.2.2. D/A Range Selection 7
2.3. Connector Pin Assignment 7
2.4. Plugging the PCL-711B into Your PC 9
2.5. Signal Connections 10
2.5.1. Analog Input Connection 10
2.5.2. Analog Output Connection 11
2.5.3. Digital Signal Connection 11
2.6. Software Driver 12

CHAPTER 3. CONTROLLING THE PCL-711B 13
3.1. I/O Port Address Map 13
3.2. A/D Conversion 14
3.2.1. A/D Data Registers 14
3.2.2. Gain Control Register 15
3.2.3. Multiplexer Scan Register 16
3.2.4. Mode and Interrupt Control Register 17
3.2.5. Interrupt Status Register 19
3.2.6. Software Trigger Register 19
3.3. D/A Conversion 20
3.4. Digital Input and Output 21
3.4.1. Digital Input Registers 21
3.4.2. Digital Output Registers 21
3.5. Pacer Programming 22

APPENDIX A. CALIBRATION 25
A.1. VR Assignments 25
A.2. D/A Calibration 27
A.3. A/D Calibration 27

APPENDIX B. INTEL 8253 REFERENCE 29
B.1. Operation Modes 29
B.1.1. Mode 0 Stop on Terminal Count 29
B.1.2. Mode 1 Programmable One-Shot 29
B.1.3. Mode 2 Rate Generator 29
B.1.4. Mode 3 Square Wave Generator 30
B.1.5. Mode 4 Software Triggered Strobe 30
B.1.6. Mode 5 Hardware Triggered Strobe 30
B.2. Counter Control Register Format 31

CHAPTER 1. INTRODUCTION

The PCL-711B PC-MultiLab Card is an easy-to-use and cost/effective IBM PC/XT/AT compatible multifunction data acquisition card. This card's specifications and user-friendly software driver make it a popular solution for a wide range of industrial and laboratory applications. Such applications include: data acquisition, process control, automatic testing, and factory automation.

1.1. Features

- 12-bit resolution A/D conversion
- Accepts 8 single-ended analog inputs
- Programmable analog input ranges: ±5V, ±2.5V, ±1.25, ±0.625V, ±0.3125V
- Support software trigger, programmable pacer trigger, and external trigger
- Programmable IRQ level for A/D data transfer
- One 12-bit multiplying D/A output channel, with the output range of 0 to +5V or 0 to +10V
- On-board 16-bit digital input and digital output
- Versatile language drivers including BASIC, PASCAL, C and C++

1.2. Specifications

1.2.1. Analog Input (A/D Converter)

Channels: 8 single-ended inputs.

Resolution: 12 bits, successive approximation.

Input range: ±5V, ±2.5V, ±1.25, ±0.625V, and ±0.3125V, software programmable.

Converter: AD574 or equivalent.

Conversion time: 25μs max.

Accuracy: 0.015% of reading $\pm$1 LSB.

Nonlinearity: $\pm$1 bit.

Amplification gains: x1, x2, x4, x8, and x16, software programmable.

Trigger mode: By software, pacer and external trigger.

Data transfer: By software or interrupt.

Overvoltage: Continuous $\pm$30V max.

IRQ level: IRQ2 to IRQ7.

1.2.2. Analog Output (D/A Converter)

Channels: One channel.

Resolution: 12 bits

Output range: 0 to +5V or 0 to +10V.

Settling time: 30μs.

Reference voltage: Internal -5V and -10V ($\pm$0.05V).

Converter: PM7548GP or equivalent.

Nonlinearity: $\pm$½ LSB.

Output capacity: $\pm$5mA max.

1.2.3. Digital Input

Channels: 16 bits, TTL compatible

Input voltage: Low - 0.8V max.
High - 2.0V min.

Input load: Low - 0.4mA max. @0.5V
High - 0.05mA max. @2.7

1.2.4. Digital Output

Channel: 16 bits, TTL compatible

Output voltage: Low (sink): 8mA @0.5V max.
High (source): 0.4mA @2.4V min.

1.2.5. General Specifications

Power consumption:
+5V: 100mA, typical; 500mA max.
+12V: 40mA, typical; 100mA max.
-12V: 20mA, typical; 50mA max.

I/O connector:
- One 20-pin connector for A/D and D/A
- One 20-pin connector for digital input
- One 20-pin connector for digital output

I/O ports: requires 16 consecutive I/O ports per card

Operating temperature: 0 to 50°C (32 to 122°F).

Storage temperature: -20 to 65°C (-4 to 149°F).

Weight: 127 gm (4.49 oz.).

CHAPTER 2. INSTALLATION

2.1. Initial Inspection

The PCL-711B was thoroughly inspected before being shipped to you. Before installing the card into your PC, make sure that everything has been included with the package. You should also inspect the card for any defects or damages that may have occurred during shipment. If you find anything missing, defective or damaged, contact your PC-LabCard dealer immediately.

Here is a list of the materials included with your PCL-711B package:

- One PCL-711B PC-MultiLab Card
- One User's Manual
- One utility diskette which includes the card's software driver

In the PCL-711S package, two additional accessories are also included:

- One PCLD-7115 Wiring Terminal Board
- One 1 meter cable

2.2. Switch and Jumper Settings

The PCL-711B has been designed with ease-of-use in mind. On board the card you will notice that there is only one DIP switch (SW1), and only one set of jumper pins (JP1). These are used to set the PCL-711B's base address, and to select its D/A output voltage range. The following sub-sections go into this in more detail.

2.2.1. I/O Address Selection

Most peripheral devices and interface cards are controlled via your PC's I/O ports. These devices and cards should be placed in an appropriate I/O space so that there will be no conflicts between them and the PCL-711B. Keep in mind that the PCL-711B uses 16 consecutive address locations in your PC's I/O space. Appendix A provides an I/O port address map for your reference. This will assist you in locating an appropriate address for your peripheral devices and interface cards.

I/O port base addresses are selected from the 6-position DIP switch, SW1, on-board the PCL-711B. Valid addresses are from 000 to 3F0 (hexadecimal). The factory default address setting is 220. From time to time, you may find that you will have to use some of these spaces for other devices. If this is the case, then you can change the address according to the information given in the following table.

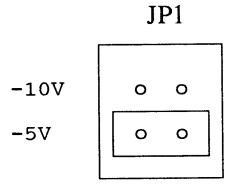
I/O ADDRESS RANGE (HEXADECIMAL)	SWITCH POSITION (SW1) 1 A9	2 A8	3 A7	4 A6	5 A5	6 A4
000 - 00F	0	0	0	0	0	0
100 - 10F	0	1	0	0	0	0
.						
.						
200 - 20F	1	0	0	0	0	0
210 - 21F	1	0	0	0	0	1
220 - 22F *	1	0	0	0	1	0
.						
300 - 30F	1	1	0	0	0	0
.						
3F0 - 3FF	1	1	1	1	1	1

NOTE: 0 = ON, 1 = OFF
A4 through A9 correspond to your PC's address lines.
* Factory default

2.2.2. D/A Range Selection

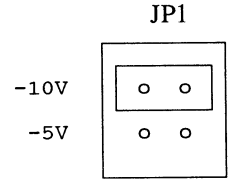
PCL-711B's D/A output range depends on the reference voltage you select at the jumper, JP1. The reference voltages can be assigned as either -5V or -10V, which gives you an D/A output range of 0 to +5V or 0 to +10V, respectively.

When an D/A output range of 0 to +5V is required, set the jumper to -5V (see the illustration below).



*Factory default

If your application requires an D/A output range of 0 to +10V, then set the jumper to -10V (refer to the illustration below).



NOTE: When -10V reference is selected, the maximum D/A output voltage should be +10V. However, it may be less than +10V because the +12V voltage source supplied by your PC may be lower than +11.5V which is required by the D/A circuit.

2.3. Connector Pin Assignment

The PCL-711B is equipped with three 20-pin connectors. Two connectors are located at CN3 and CN4. These are used for digital input (CN4), and digital output (CN3). The third connector is located at CN1, and is used for analog I/O.

Each of these connectors can be connected with the same type of ribbon cables. They can also be connected to a D37 connector using the PCLK-1050 industrial wiring kit.

An illustration of each of these connectors are given in the following illustrations.

Key:

A/D	=	Analog input
AGND	=	Analog ground
D/A	=	Analog output
D/O	=	Digital output
D/I	=	Digital input
DGND	=	Digital ground
VREF	=	Voltage reference

Analog I/O (CN1)

A/D 0	1	2	AGND
A/D 1	3	4	AGND
A/D 2	5	6	AGND
A/D 3	7	8	AGND
A/D 4	9	10	AGND
A/D 5	11	12	AGND
A/D 6	13	14	AGND
A/D 7	15	16	AGND
D/A	17	18	AGND
AGND	19	20	AGND

Digital Output (CN3)

D/O 0	1	2	D/O 1
D/O 2	3	4	D/O 3
D/O 4	5	6	D/O 5
D/O 6	7	8	D/O 7
D/O 8	9	10	D/O 9
D/O 10	11	12	D/O 11
D/O 12	13	14	D/O 13
D/O 14	15	16	D/O 15
DGND	17	18	DGND
+5V	19	20	+12V

Digital Input (CN4)

D/I 0	1	2	D/I 1
D/I 2	3	4	D/I 3
D/I 4	5	6	D/I 5
D/I 6	7	8	D/I 7
D/I 8	9	10	D/I 9
D/I 10	11	12	D/I 11
D/I 12	13	14	D/I 13
D/I 14	15	16	D/I 15
DGND	17	18	DGND
+5V	19	20	STROB

2.4. Plugging the PCL-711B into Your PC

Before you plug the PCL-711B into your PC, make sure that the computer's power is turned off, and that all power cords and peripheral devices have been disconnected from the system.

Use the following procedures as a guideline for plugging the PCL-711B into your computer.

1. Remove the cover from your PC's chassis, and locate a vacant expansion slot on your passive backplane or motherboard for installing the PCL-711B.

2. Take the card and insert its edge connector into the expansion slot, pressing the card firmly into place. Use the card's mounting bracket as a guide between the chassis' rear panel and backplane or motherboard.

3. Once you have inserted the card firmly into the slot, secure it to the chassis by fastening its mounting bracket with a screw.

4. Attach any ribbon cables to connectors CN1, CN3, and CN4 that your application may require.

5. Now, replace the chassis cover, and connect any power cords and peripheral cables that you disconnected.

The PCL-711B's installation is now complete.

2.5. Signal Connections

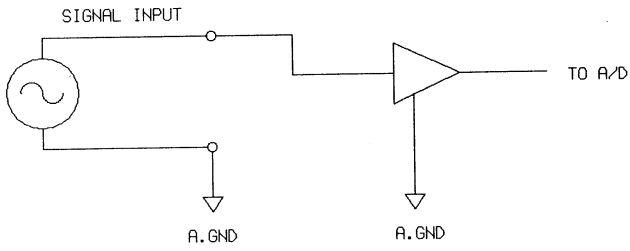
Since most data acquisition applications involve voltage measurement, it is important to make the correct signal connections in order to avoid any damage to your system, and insure accurate data acquisition. This chapter provides some helpful information about making the appropriate and proper signal connections for your application.

2.5.1. Analog Input Connection

As you already know, the PCL-711B supports eight single-ended analog inputs. A single-ended analog input connection uses only one signal wire connected to an analog input terminal which references to a common ground. For example, in order to measure a battery's voltage, simply connect its negative side to the PCL-711B's ground (any one of the AGND pins on connector CN1), and its positive side to one of the card's analog input channels.

NOTE: The PCL-711B does not support differential signal source inputs.

The following diagram illustrates a single-ended, common ground, analog input connection:

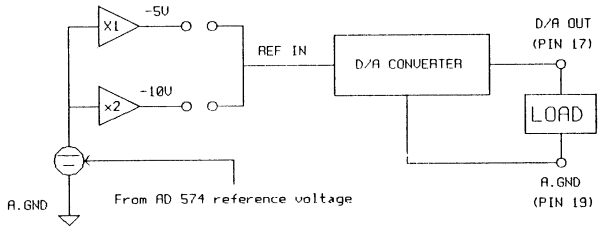


Single-Ended Analog Input Connection

2.5.2. Analog Output Connection

The PCL-711B is equipped with an internal -5 and -10V reference source which generates an output of 0 to +5 and 0 to +10V D/A output. The PCL-711B only provides one D/A output channel. Use Connector CN1 for making your analog output.

The following diagram illustrates a typical analog output or D/A connection:

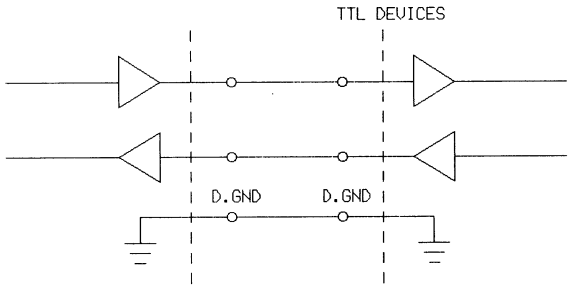


Analog Output Connection

2.5.3. Digital Signal Connection

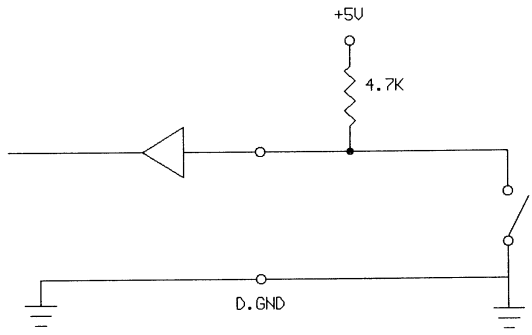
As mentioned in Chapter 1, the PCL-711B provides 16 digital input and 16 digital output channels for usage in digital input/output applications, such as timer/counter operations. All digital I/O levels are TTL compatible.

In order to transmit or receive a digital signal to or from other TTL devices, make your signal connection as illustrated in the following diagram:



Digital Signal Connection

To receive an OPEN or SHORT signal from a switch or relay , a pull up resistor must be installed on the PCL-711B. This resistor ensures that a high signal level will be maintained when the switch is open. Refer to the diagram illustrated below for an example of an OPEN/SHORT signal connection.



OPEN/SHORT Signal Connection

2.6. Software Driver

The PCL-711B is supported by Advantech's standard, user-friendly software driver. This driver allows you use standard functions, written in common programming languages, to operate the PCL-711B, without going into detailed register control. Languages supported by the software driver include BASICA, GWBASIC, QUICKBASIC, Microsoft C/C++ and PASCAL, Borland C/C++ and Turbo PASCAL. Please refer to the manual for the software driver for more information.

CHAPTER 3. CONTROLLING THE PCL-711B

This chapter has been written for those of you who wish to write their own software driver instead of using the PCL-711B's. Here, you will find detailed information about the PCL-711B's register formats and control procedures.

3.1. I/O Port Address Map

The following table shows you which base I/O addresses are used by the PCL-711B. Refer to this map from time to time in order to become familiar with each of the card's register formats and their purpose. 16 consecutive registers corresponding to their I/O addresses are used to control the PCL-711B's various functions. The following table has been provided in this chapter as a preface which outlines these addresses relative to their location and control (read or write) assignments.

LOCATION	READ	WRITE
BASE+0	Counter 0	Counter 0
BASE+1	Counter 1	Counter 1
BASE+2	Counter 2	Counter 2
BASE+3	N/A	Counter Control
BASE+4	A/D low byte	D/A low byte
BASE+5	A/D high byte	D/A high byte
BASE+6	D/I low byte	N/A
BASE+7	D/I high byte	N/A
BASE+8	N/A	Clear interrupt status
BASE+9	N/A	Gain control
BASE+10	N/A	Multiplexer scan control
BASE+11	N/A	Mode and interrupt control
BASE+12	N/A	Software A/D trigger
BASE+13	N/A	D/O low byte
BASE+14	N/A	D/O high byte
BASE+15	N/A	N/A

The sections that follow provide further information about each register's data format according to its specific operation.